

MIDTRIASSIC NEW GENERA AND SPECIES OF MESOPANORPODIDAE (INSECTA, MECOPTERA) FROM SHAANXI, CHINA

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Abstract Three new genera and four new species: *Langfurula hejiafangensis* gen. et sp. nov., *Allocorista erdosensis* gen. et sp. nov., *Ladindochorista lata* gen. et sp. nov., *Itaphlebia tongchuanensis* sp. nov. (Mesopanopodidae Tillyard, 1918) are described. The specimens are collected from the Upper part grayish green mudstone and shale of the Lower Member of the Middle Triassic Tongchuan Formation (Tr_{2t}), Tongchuan Region, Shaanxi Province, China.

According to the venational characters, especially Rs and M with 4 branches respectively, these new genera and species should be referred to Mesopanopodidae and belong to new members of the Tongchuan Entomasssemblage of Shaanxi Entomofauna (one group of Shaanxi fauna or Shaanxi Biota). The Tongchuan Formation, bearing insects and other fossils, can be corresponded to European Midtriassic Ladinian stage.

Key words Mesopanopodidae, Midtriassic, Tongchuan Formation (Tr_{2t}), Shaanxi Entomofauna, Tongchuan Entomasssemblage.

The Mesopanopodidae as an extinct family, distributed widely in the Australia ($P\ Tr_3$), South Africa (Tr_3) and Asia (Tr_2-K_1), has been previously reported by Bode (1953), Carpenter (1992), Guo and Hong, 2003, Handlirsch (1906-1908), Hong (1998), Hong, Guo et Wang (2002), Hong et Guo (2004), Hong (2005), Hong, Guo et Li (2005), Martynova (1959, 1962), Novokschonov (1994, 1995, 1998, 2001), Novokschonov et Sukatcheva (2001, 2003), Riek (1950, 1953), Sukatcheva (1980, 1985, 1990), Tillyard (1926, 1933), Willmann (1984, 1987).

Many new fossil mesopanopodids were discovered from the Upper part grayish green mudstone and shale of the Lower Member, Middle Triassic Tongchuan Formation (Tr_{2t}), belonging to the Southeastern marginal part of the Erdos basin within the boundaries of the Platform of North China. These new genera and species should belong to the new members of the Tongchuan Entomasssemblage of the Shaanxi Entomofauna (one group of Shaanxi Biota) (Hong, 1998). They are described as follows.

The geological age of Tongchuan Formation (Tr_{2t}), can be corresponded to European Ladinian stage according to the study results on the flora and faunas. It yields following fossil assemblages, plant: *Plavromeria-Equisites-Danaeopsis-Glossopteris-Neocalamites* assemblage; Sporopollen: *Punctatisporites-Piceapollenites* assemblage; Bivalvia: *Shaanxiancha-Sibireconcha* assemblage; Conchostraca: *Palaeolimnadiids-Eustheria* assemblage; Ostracoda: *Tonghuania-Darwinula* assemblage; Insecta: *Anusolhatta reda-Magniaiaida shaanxiensis* assemblage;

Tariopsids (Notosteca): *Xinjiangiops tongchuanensis-Xinjiangiops discreta-Xinjiangiops hejiafangensis* assemblage.

The holotypes are preserved in Beijing Museum of Natural History, Beijing, China.

Taxonomic descriptions

Insecta Linne, 1758

Mecoptera Packard, 1886

Eumecoptera Tillyard, 1933

Mesopanopodidae Tillyard, 1918

Characters. Forewing wide; Sc extended usually to Pt (pterostigma) region; Pt usually distinct, sometimes indistinct; Rs + MA and MP respectively with 4 branches; MP coalesced with CuA basally and diverging anteriorly at its separation from CuA.

Distribution. Australia, Europe, Middle Asia, China, South Africa; Upper Permian Early Cretaceous ($P\ Tr-K_1$).

1 *Langfurula* gen. nov.

Etymology. From the Latin longa long and furca fork.

Type species: *Langfurula hejiafangensis* sp. nov.; Middle Triassic Tongchuan Formation (Tr_{2t}) of the Tongchuan region, Shaanxi Province, China.

Diagnosis. Sc reached beyond midwing and forked into 3 very long branches; R waved; Rs+MA and MP respectively forked deeply, their branches very long; but stems of Rs_{1+2} and Rs_{3+4} and stems of MA_{1+2} and MA_{3+4} , respectively shorter slightly than that of the base Rs; forking point of MP earlier slightly little than the original point of Rs+MA.

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Comparison. According to the venational features of the new genus, it can be distinguished from the known genera of Mesopanorpidae in Sc, Rs+ MA and MP forking deeply; the base Rs+ MA and MP, stems of Rs_{1+2} , Rs_{3+4} , MA_{1+2} , MA_{3+4} and MP_{1+2} , MP_{3+4} very short respectively; the base Rs longer than common stem of the MA.

Although the new genus is similar to *Allochorista* gen. nov. in the Rs+ MA forking dichotomously deeply, but

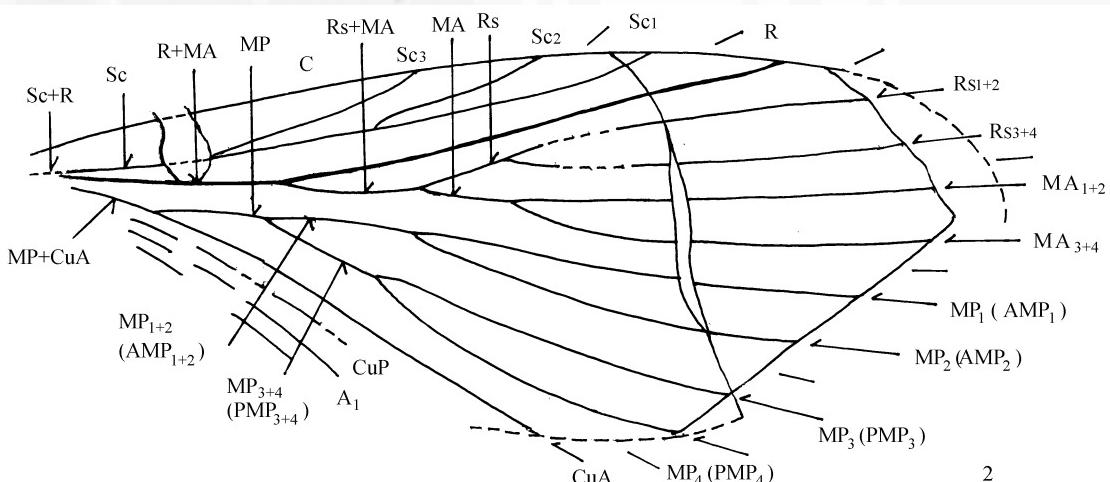
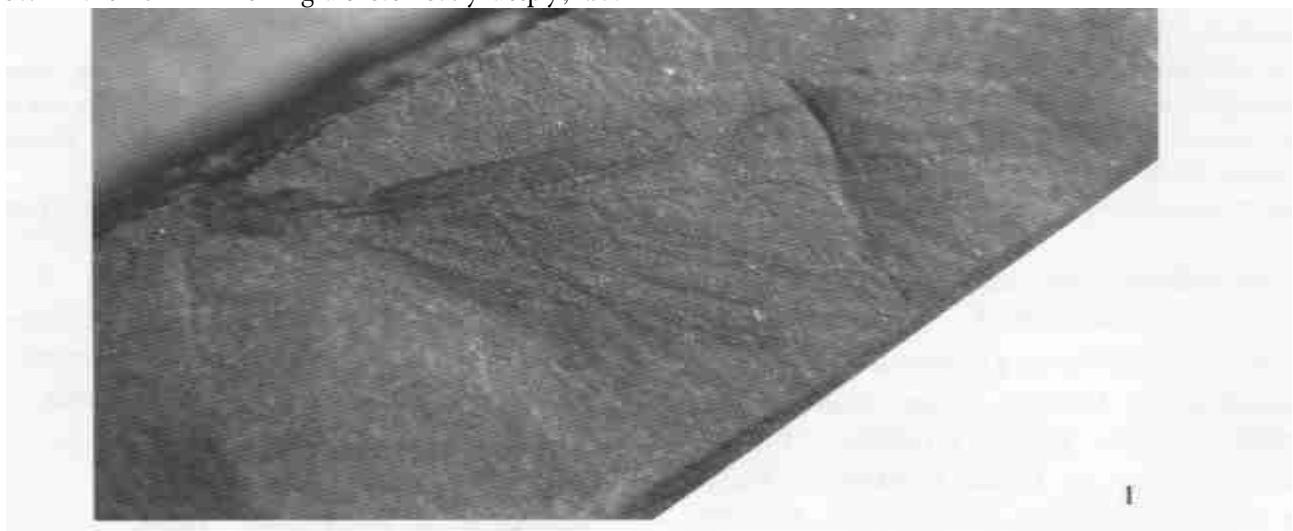
differs from it in the MP forking in comb-like.

Distribution. Shaanxi Province, China; Middle Triassic (Tr₂).

Longifurcula hejiafangensis sp. nov. (Figs. 1-2)

Holotype 82THr-1/T074.

Etymology. From the Hejiafang Hejiafang Village (fossil locality) within Tongchuan region.



Figs 1-2. *Longifurcula hejiafangensis* sp. nov.; holotype 82THr-1/T074. 1. Forewing, 6.20×. 2. Forewing, venational character. G Costa, Sc subcosta, Sc_1 - Sc_3 ist third branches of Subcosta, $Sc+R$ merged vein of Subcosta and Radius, R Radius, Rs Radiosector, Rs_{1+2} and Rs_{3+4} anterior and posterior branches of Radiosector, $R+MA$ merged vein of Radius and anterior branch of Media; $Rs+MA$ merged vein of Radiosector and anterior branch of Media M Media, MA anterior branch of Media MA_{1+2} - MA_{3+4} anterior and posterior branches of anterior branch of Media, MP posterior branch of Media, MP_{1+2} , MP_{3+4} anterior and posterior branches of Median posterior branch MP+ CuA merged vein of Median posterior branch and anterior branch of Cubitus, CuA, CuP anterior and posterior branches of Cubitus, A_1 -st branches of anal veins.

Attention: scale bar 1 mm, including all text figs in this paper and explanations of all venational terms see in Fig 2.

Materials. Possible two overlapping forewings. The anterior part of anal area preserved incompletely, wing terminal margin damaged, but all main veins preserved distinctly.

Description. Forewing, the anterior margin arched slightly; Sc arched and reached beyond midwing, with 3 long branches (Sc_1 - Sc_3) in costal margin; R single,

waved and extended before the wing apex, and paralleled to Sc; the bases of Rs MA short, and forked deeply; $Rs+MA$ longer conerically than MA; the main stem of MP shorter and then connected directly to CuA and forked into four branches, the common stems MP_{1+2} longer a little than that of the MP_{3+4} ; all branches of $Rs+MA$ and MP forked very deeply; the base CuA

arched slightly; the anterior part of CuP, A₁ and A₂ closed to CuA; the wingface without crossveins.

Measurements. Forewing preserved length 6.5 mm, width 2.5 mm.

Locality and Horizon. Tongchuan region of Shaanxi Province, China; the specimen is collected from the grayish green mudstone and shale of the Upper part of the Lower Member, Middle Triassic Tongchuan Formation (Tr_{2t}).

2 Allochorista gen. nov.

Etymology. The generic name consists of the Greek *allo* different and the old generic name *Chorista*.

Type species: *Allochorista erdosensis* sp. nov.; Middle Triassic Tongchuan Fromation (Tr_{2t}) of the Tongchuan region of Shaanxi Province, China.

Diagnosis. Forewing, Sc short, not reached midwing in anterior margin; costal space about 2-3 times as wide as that of subcostal; both Sc and R single; R extended beyond midwing; main stem of Rs very short

and forked early into stems Rs₁₊₂; main stem of MA very longer than main stem Rs or Rs+ MA or R+ MA; then MA coslesced with Sc and formed a merged vein Sc + R+ MA; stem Rs branched obviously earlier than that of MA, all branches of Rs and MA long; M with 4 branches, arranging in comb-like, and coalesced with CuA.

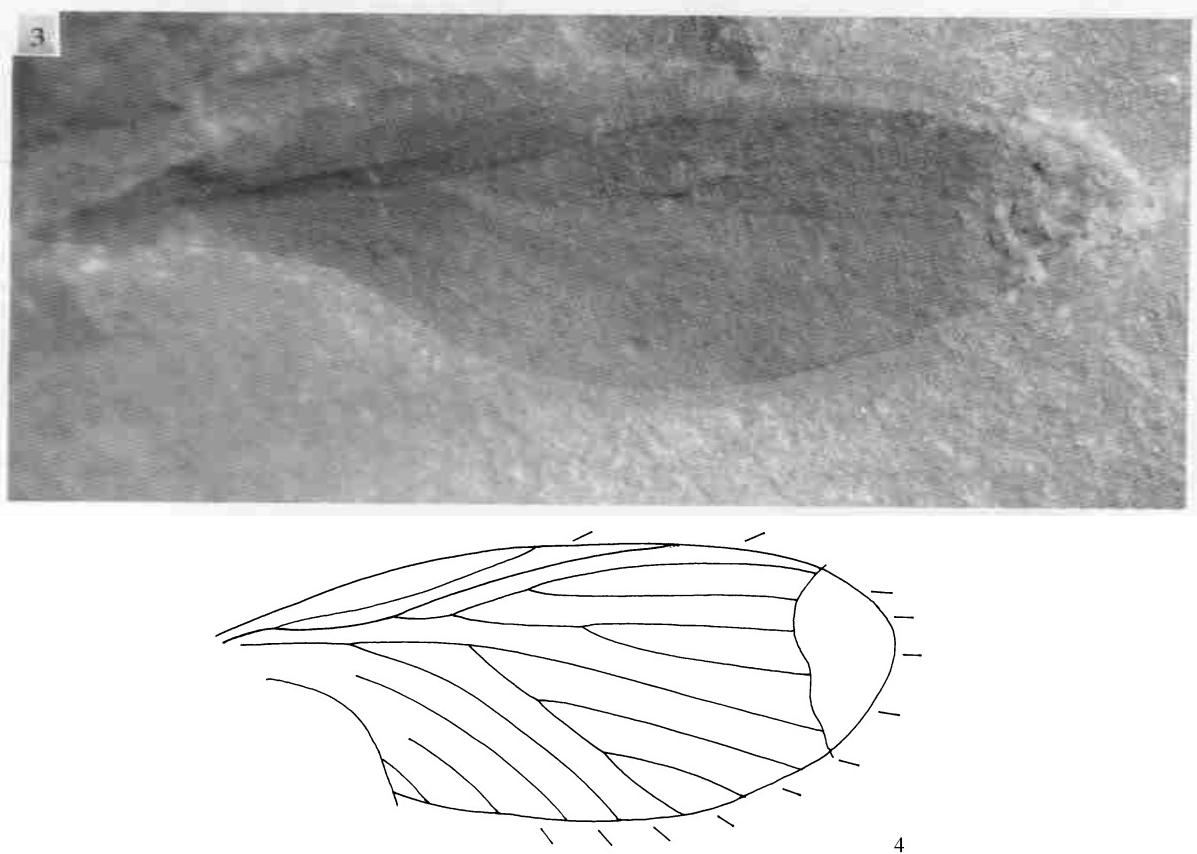
Comparison. The new genus can be distinguished from the known genera of Mesopanorpidae in the main stem of the Rs very short, costal space about 2-3 times as wide as that of subcostal, 4 branches of MP arranged in comb-like.

Distribution. Shaanxi Province, China; Middle Triassic (Tr₂).

Allochorista erdosensis sp. nov. (Figs. 3-4)

Holotype 82TH6 1/T001.

Etymology. Erdos from the Erdos basin, showing the fossil locality within the Erdos basin.



Figs 3-4 *Allochorista erdosensis* sp. nov.; holotype 82TH₆ 1/T001. 3. Forewing, 11. 30×. 4. Forewing venational character.

Materials. Forewing, base of anal veins damaged; terminal part and other parts of the wing and their veins are preserved distinctly, but some veins show indistinctly in the fossil photo.

Description. Forewing long oval, anterior margin arched widely, posterior margin concaved; Sc base coalesced with R near the wing base, and formed a

merged vein Sc + R; the costal area wide, about 2-3 times as wide as that of the subcostal area; R thick and single, waved and extended beyond midwing; Rs+ MA very short but MA very long, about twice as long as that of Rs; Rs forked early into stems Rs₁₊₂ and Rs₃₊₄ and branched earlier than the MA, MP base coalesced directly with CuA, and forked into 4 branches arranging

upperwards in comb like; bases of CuP, A₁ and A₂ damaged, but their terminal parts are distinctly.

Measurements. Forewing preserved length 8 mm, width 3.1 mm.

Locality and Horizon. Tongchuan region of Shaanxi Province, China; the specimen is collected from the grayish green mudstone and shale of the Upper part of the Lower Member, Middle Triassic Tongchuan Formation (Tr_{2t}).

3 Ladinodchorosta gen. nov.

Etymology. From the Greek Ladinian a geological stage of the Midtriassic and old generic name *Chorista*.

Type species: *Ladinodchorosta lata* sp. nov.; Middle Triassic Tongchuan Formation (Tr_{2t}) of the Tongchuan region of Shaanxi Province, China.

Diagnosis. Wing wide; R, Rs, MA, MP and their branches obviously thick, other veins weak; Sc single, long, extended to Pt region; R single, paralleled to Sc; stem of Rs and MA long, but the latter longer obviously than the former and zyaged upwards; Rs and MA respectively forked into anterior and posterior branches; Rs stem of MP very long, and forker into MP₁₊₂ and MP₃₊₄; stem MP₁₊₂ branched later than that of MP₃₊₄; MP coalesced with CuA basally; radial area wide,

maximum width at separating point of Rs with MA; Pt indistinct.

Comparison. According to Sc long, running to Pt region, especially Rs+ MA and MP respectively with 4 branches of the new genus, it should be referred to Mesopanorpidae, however, it can not belonged to Nannochoristidae Tillyard, 1917, because its Rs with only three branches.

The new genus is similar to *Itahplebia* Sukacheva, 1985, but differs from it in wing wide and short, the round terminal margin of the wing, Sc very straight and long, and without branches.

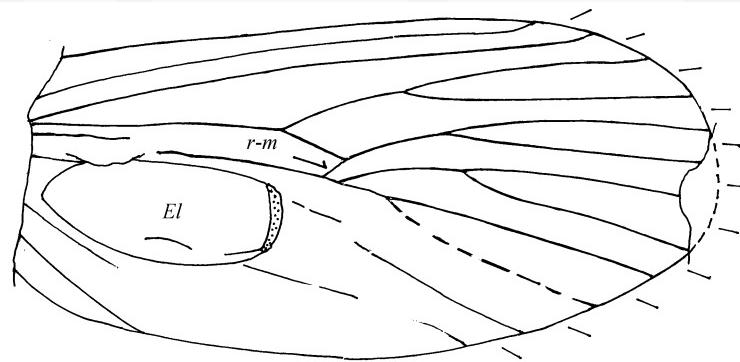
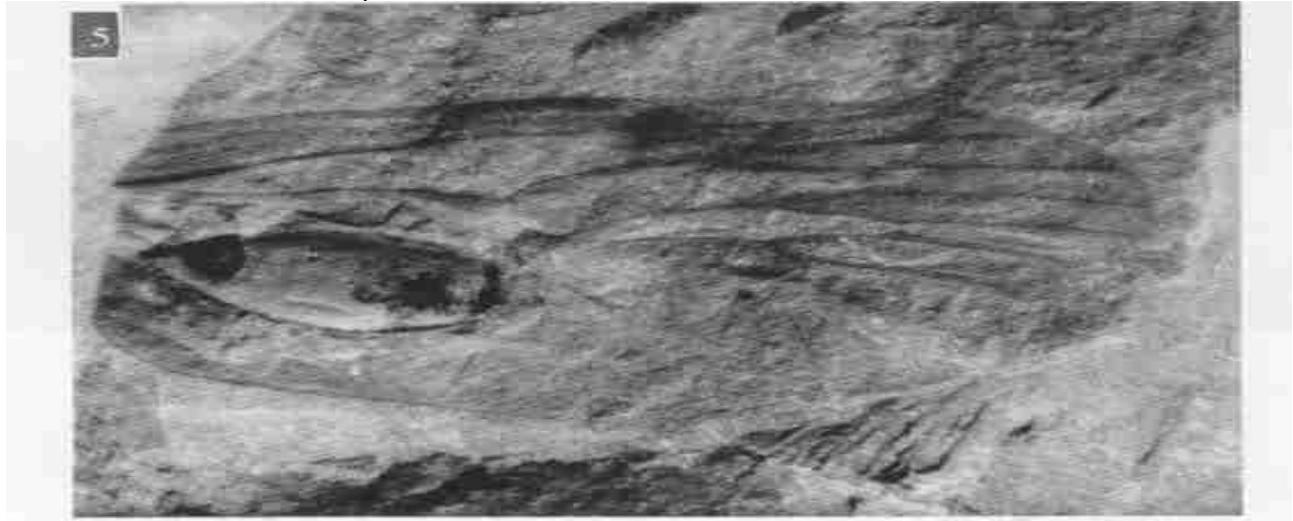
Besides, this genus can be distinguished from known genera with in this family in R, MA, MP and their branches thicker conspicuously than other veins (Sc, CuA, CuP and A); Sc long and single, R single, Rs forked earlier than MA.

Distribution. Shaanxi Province, China; Middle Triassic (Tr₂).

Ladinodchorosta lata sp. nov. (Figs. 5-6)

Holotype 82TH6 1/T222.

Etymology. From the Latin *lata* wide, showing the wide wing.



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Figs 5-6. *Ladinodchorosta lata* sp. nov.; holotype 82TH₆ 1/T222. 5. Forewing, 12×. 6. Forewing venational character.

Materials. Possible two overlapping hindwings (?). Bases of Sc, R, Rs, Cu and A₁-A₃ damaged, but other parts of the veins well preserved. Besides, a small elytra (Coleoptera) covered on the cubitoanal area of the wing face.

Description. Hindwing (?) wide, maximum width about at CuP end; costal margin straight, wing wide and short, its apex round; Sc long extended to Pt region, but unbranched; R single, very thick, paralleled to Sc; main stem Rs+ MA long, stretched downwards, then Rs curved upwards and forked into stems of Rs₁₊₂ and Rs₃₊₄; MA they reached wing margin; the later stretched downwards and forked into MA₁₊₂, MA₃₊₄; Rs branch earlier Rs₃ and Rs₄; stem Rs₁₊₂ branched earlier than that of stem Rs₃₊₄; stem Rs₃₊₄ curved suddenly upwards and combined with r-m; main stem MP very long, stretched downwards and forked into stems of MP₁₊₂ and MP₃₊₄, stem MP₁₊₂ about 2.5 times as long as that of

MP₃₊₄; CuA, CuP and A₁ preserved incompletely; Pt indistinct; the wingface clothed irregular brown maculae, especially at the posterior part of the wing.

Measurements. Hindwing (?) preserved length 10 mm, width 5 mm.

Locality and Horizon. Tongchuan region of Shaanxi Province, China. The fossil is collected from the grayish green shale and mudstone of the Upper part of the Lower Member of Tongchuan Formation (Tr_{2t}).

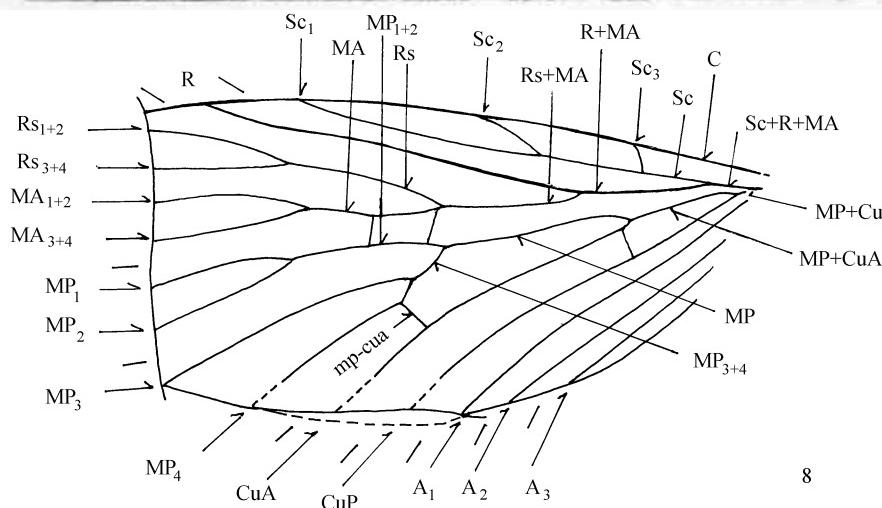
4 Itaphlebia Sukatcheva, 1985

Itaphlebia tongchuanensis sp. nov. (Figs. 7-8)

Etymology. From the fossil locality Tongchuan of Shaanxi Province.

Holotype 82TH₂/T144.

Materials. Only one forewing specimen, its posterior part damaged, but its venation preserved distinctly.



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Figs 7-8. *Itaphlebia tongchuanensis* sp. nov.; holotype 82TH₂/T144. 7. Forewing, 7. 10 × 8. Forewing venational character, explanations of venational terms see in Fig. 2.

Description. Forewing greater size, long (14 mm) and broad (5 mm); the costal margin arched widely;

costal area broader slightly than subcostal; Sc long, extended beyond midwing in costal margin and forked

into 3 branches: Sc_1 , Sc_2 and Sc_3 ; Sc_1 longest, Sc_2 bend slightly and longer than Sc_3 , Sc_3 shortest and almost straight; the main stem of $R+$ MA coalesced with the base Sc and formed a merged vein $Sc+R+MA$; the base of R stretched downwards obliquely, then running upwards and paralleled to Sc ; the base of $Rs+MA$ arising remonte from base R and forked into 2 common stems of the Rs_{1+2} and Rs_{3+4} before the midwing, the Rs forked a little later than MA ; but longer than that of MA ; MA bend obviously; main stem of the $Rs+MA$ shorter slightly than that of the Rs , but longer than MA , then $R+MA$ connected with Sc and formed a merged vein $Sc+R+MA$; the basis of MP bend suddenly and coalesced directly with CuA and formed a merged vein: $MP+CuA$, then coalesced again with CuP basally; and formed a merged vein $MP+Cu$; MP forked into 4 branches: MP_1-MP_4 , among them the MP_{1+2} branched very later than that of MP_{3+4} , so its length about 2.8 times as long as that of the latter; CuP stretched downwards remonte from CuA ; CuP , A_1 , A_2 , A_3 respectively single and almost paralleled to each other; crossveins rare, only 4 branches, among them a crossvein ($mp-cua$) situated between the MP_4 and CuA , and another three crossveins: two $ma mp$ and $cua cup$; wingsurface clothed by at least 4 brown color bands, among them the fourth band broadest than others.

Measurements. Forewing, preserved 11 mm long (about may be 14 mm), 5 mm wide.

Taxonomic position of *Itaphlebia*: In 1985, the genus *Itaphlebia* was established by Dr. Sukatcheva, I. D. and referred to family Mesopanorpidae Tillyard, 1918 to 2003, Drs. Novokshonov, V. G. and Sukatcheva, I. D. considered that the *Itaphlebia* should be transferred to Nannochoristidae from the Mesopanorpidae.

According to the venational characters of the *Itaphlebia*, especially its $Rs+MA$ with 4 branches (including MP with 4 branches), this feature conformed with Mesopanorpidae, and not conformed with features of the Nannochoristidae, because one important feature of the latter is $Rs+MA$ only with 3 branches, thus it seems not appropriate that *Itaphlebia* is referred to Nannochoristidae Tillyard, 1917. So it is appropriate that of *Itaphlebia* assigned to Mesopanorpidae.

The new species is similar to *Itaphlebia generosa* Novokshonov, V. G. and Sukatcheva, I. D., 2003, but differs from it in its forewing very long (length is about 14 mm and width is 5 mm), the length of merged vein $Rs+MA$ is shorter than that of the stem Rs , Rs forked later than the MA , Sc_2 long and bend.

Measurements. Forewing preserved length 14 mm, width 6 mm.

Locality. Tongchuan region of Shaanxi Province, China; Middle Triassic Tongchuan Formation (Tr_{2t}).

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中国陕西中三叠世中蝎蛉科三新属新种（昆虫纲，长翅目）

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摘要 记述中蝎蛉科 Mesopanorpidae 4 属 4 种，其中包括 3 新属 4 新种：*Longifurula hejafangensi* gen. et sp. nov., *Ladinochorista lata* gen. et sp. nov., *Allochorista erdensis* gen. et sp. nov., *Itaphlebia tonghuaniensis* sp. nov.。化石标本采自陕西铜川中三叠统铜川组下段上部的灰绿色泥岩和页岩。这些新属、

关键词 中蝎蛉科，中三叠世，铜川组，陕西昆虫群，铜川昆虫组合。

中图分类号 Q915.819.7

种系陕西昆虫群铜川昆虫组合的新成员（属陕西动物群、陕西生物群的一个类别）。根据前人的植物、孢子、双壳、叶肢介、介形虫、昆虫化石等的研究结果，铜川组的时代划归中三叠世，相当于欧洲中三叠世拉丁尼期（Ladinian stage）。